HEARTS
Follow-up Session
2nd Annual Meeting
WP8

19 February 2025

https://indico.cern.ch/event/1500292/

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GSI

Funded by the European Union

Outline

- Tasks
- Deliverables and Milestones
- Status
- Plans for the future

Tasks

Task 8.1: Framework for user access *(GSI, M1 – M48)*

Task 8.2: GCR simulator installation in APPA cave or CBM vault *(GSI, M36 – M48)*

Task 8.3: Test of the GCR simulator *(GSI, M47 – M48)*

Deliverables and Milestones due in Y2

Deliv. No.	Deliverable name	Due date	Status	Summary
-	-	-	-	-

Milest. No.	Milestone name	Due date	Status	Summary
-	-	-	-	-

- No deliverables or milestones were due in Y2 for WP8

The achieved deliverables are available on HEARTS website page:
https://hearts-project.eu/project/deliverables/

The achieved milestones are available on HEARTS website page:
https://hearts-project.eu/project/milestones/

Upcoming Deliverables & Milestones

Deliv. No.	Deliverable name	Due date	Status
D8.1	Established framework for user access to the GCR simulator	2026-12-31	Pending
D8.2	Installation of the GCR simulator in APPA cave or CBM vault	2026-12-31	Pending
D8.3	First measurements with GCR simulator with and without shielding in APPA Cave or CBM vault at 10 GeV/n cutoff	2026-12-31	Pending

Milest. No.	Milestone name	Due date	Status
M22	Routine access for external users at FAIR GCR simulator	2026-12-31	Pending
M23	First test at FAIR GCR simulator	2026-12-31	Pending

Status Task 8.1: Framework for user access (GSI) [1/4]

User experience

- Started the process to make accessing and understanding the facility easier for users

- User Guide webpage
  - Inspired by the NSRL User Guide
  - Idea: Make an easy to understand guide for the users, both for GSI and CERN
    - Highlight similarities and differences between the facilities
  - Draft available, shared with the CERN team

https://www.bnl.gov/nsrl/userguide/

User experience

- Short Facility description added to the HEARTS webpage
- Contents
  - General Facility description
  - Typical beam parameters
  - Next expected availability
- Webpage under: https://hearts-project.eu/facilities/hearts@gsi/

HEARTS@GSI

Facility information
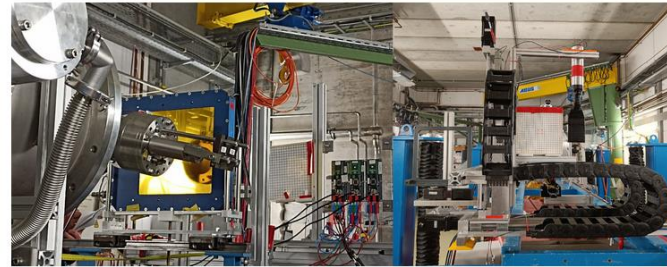
The HEARTS@GSI facility / Cave A showcasing a sample setup for electronics irradiation (left) and the current electronics target station (right). In the left picture the beam traverses from the left to right, exiting the vacuum exit window, through the beam monitors until it hits the devices under test. In the right picture the beam points towards the viewer. (Image: GSI)

General facility parameters

	Typical value	Extra information
Ion species	U	
Beam flux	$10^2 - 10^5$ ions/cm^2/s	Higher values are also possible.
Spill timing	5s length with 2s pause	The spill length is adjustable between 0.2 – 10s in length.
Beam delivery	Raster scanning	For more information see links below.
Beam size	adjustable up to 5×5cm^2	The size is freely adjustable, as magnetic raster scanning is used.
Uniformity	better than ±5%	
LET range	17 – 40 MeV·cm^2/mg	

Typical beam properties

Extraction energy [MeV/u]	Energy at DUT [MeV/u]	LET in Si [MeV·cm^2/mg]	Range in Si [mm]
900	882	17	39
600	581	19	22
400	378	22	11.9
300	275	25	7.4
200	169	32	3.6
150	113	40	2.0

Next expected availability

- June 2025 via **RADNEXT Transnational Access**
  - Note that the related RADNEXT proposals would need to be submitted during the **current RADNEXT TA call until 31st January 2025!**
- **GSI beamtime schedule** (Row "SIS" marked as "RADNEXT" in green)

Further information

- **Magnetic raster scanning**
- **Beam Monitor Calibration at GSI**

Status Task 8.1: Framework for user access (GSI) [3/4]

User experience

- Short introduction to LISE++ for simple calculations

- Development of Geant4-based template simulation
  - Quick calculation of more complicated scenarios without requiring full knowledge and experience in Monte Carlo (MC) codes

- Development of standardized user manuals and face-to-face user interaction
  - Facilitate campus access
  - Clarify general and radiation safety related topics

☐ Developments partially in use since beginning of 2024 and being refined based on user feedback

Status Task 8.1: Framework for user access (GSI) [4/4]

Access to beams

- Started development of a potential business model via the "GSI/FAIR Innovationsfond"

- Major discussion points:
  - Determination of long-term cost of running GSI/FAIR including overhead and how to fund it
  - Handling of short-term scheduling of multiple exposure opportunities per year within the long-term beamtime scheduling of GSI/FAIR

Status Task 8.2:
GCR simulator installation in the CBM vault (GSI) [1/6]

- PhD student (Luca Lunati) working on the design of the high energy GCR simulator

- Still a hybrid design for CBM, but differs from Cave A (or APPA) design
  - No beam scanning available in the CBM vault
  - Complex, rotating modulator
  - Scanning with the target, e.g. with a robotic arm
  - Has to be compatible with other equipment by other experiments in the CBM vault
    ☐ Many design constraints

- Plans and designs made how to integrate GCR Experiments into the CBM vault

Status Task 8.2:
GCR simulator installation in the CBM vault (GSI) [2/6]

- Memorandum of Understanding signed with the CBM collaboration for the installation of the GCR simulator

Memorandum of Understanding
between the
**BIOMAT Collaboration**
and the
CBM Collaboration

Quote from the preamble of the MoU

it is absolutely essential to conduct experiments with the Galactic Cosmic Ray (GCR) simulator in the CBM Cave as soon as ion beams with the highest energy from the SIS100 accelerator become available. This would immediately make FAIR the number-one laboratory in the world for simulation of space radiation.

Status Task 8.2:
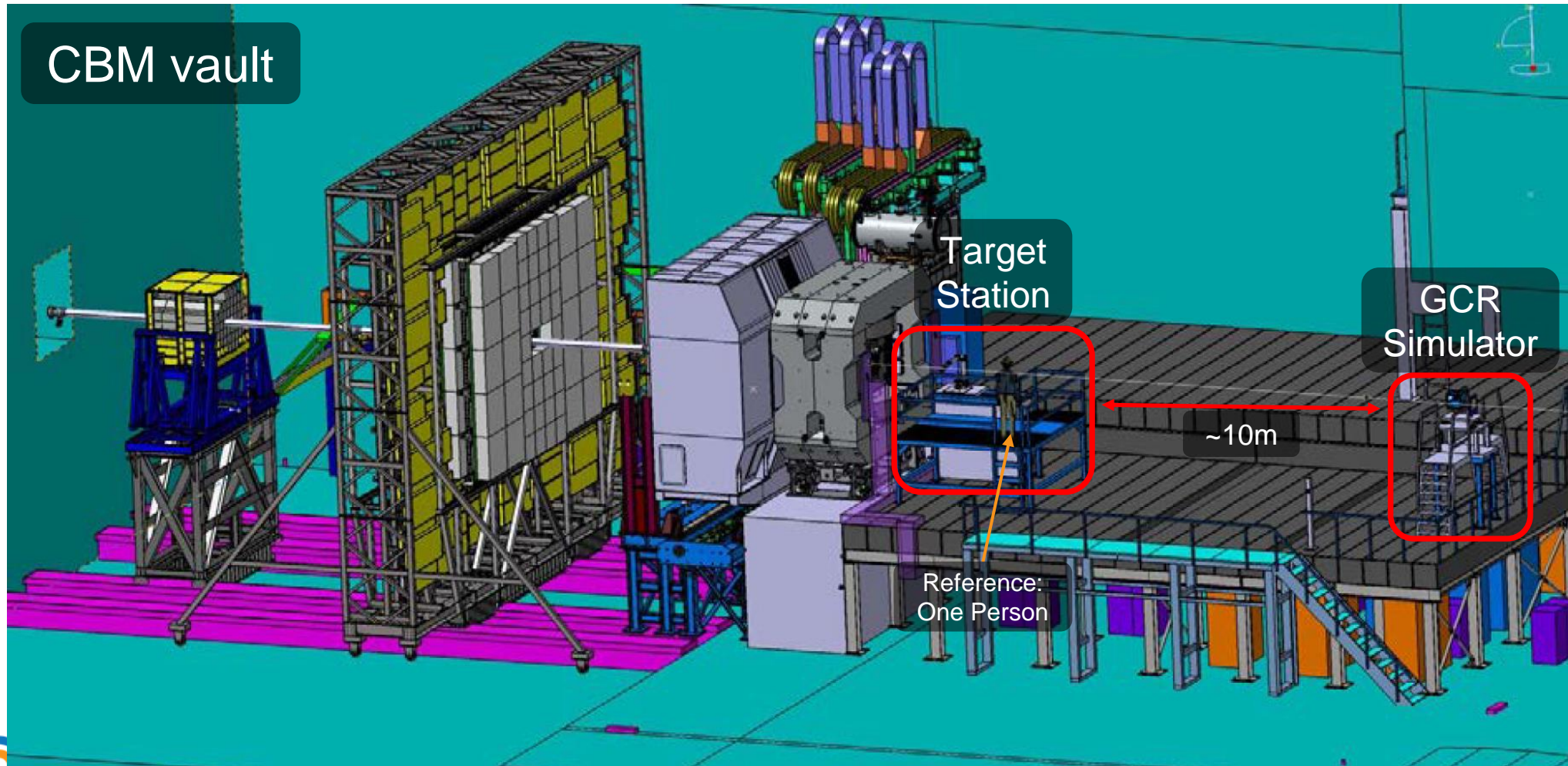# GCR simulator installation in the CBM vault (GSI) [3/6]

- Base Data simulations for the high energy (FAIR, 10 GeV/n) GCR simulator are ongoing
  - GEANT4 simulations are executed and set up
  - Computation time limited due to the GSI cluster Fair-Share
- Optimizer software for Modulators (see deliverable D3.3) is in the process of being re-written for more flexibility and compatibility to the high energy GCR simulator
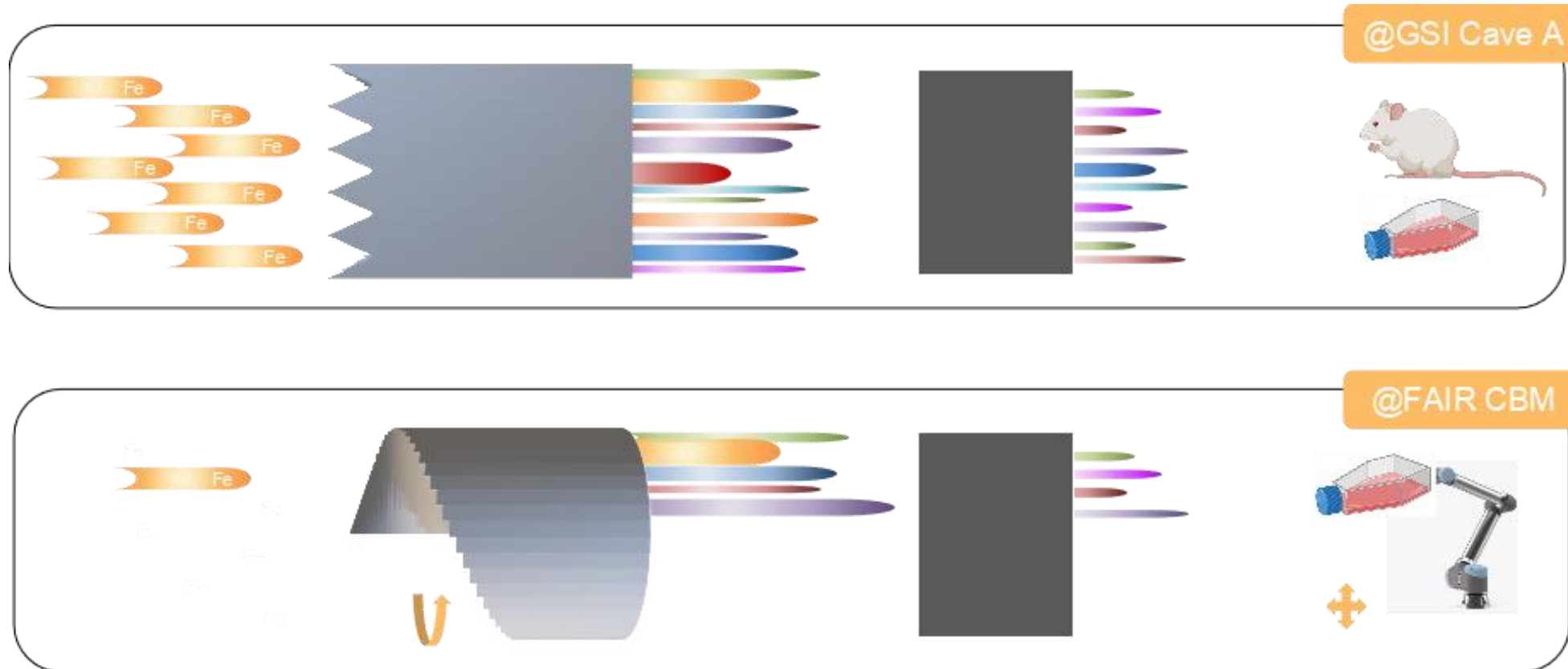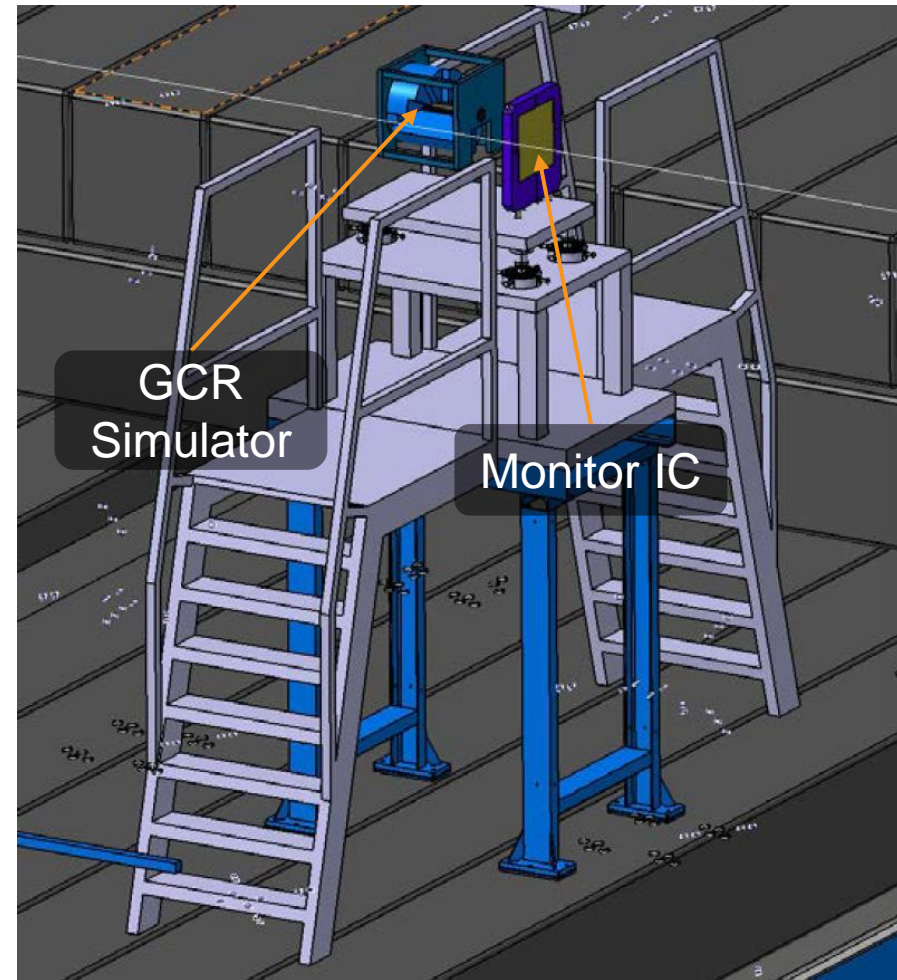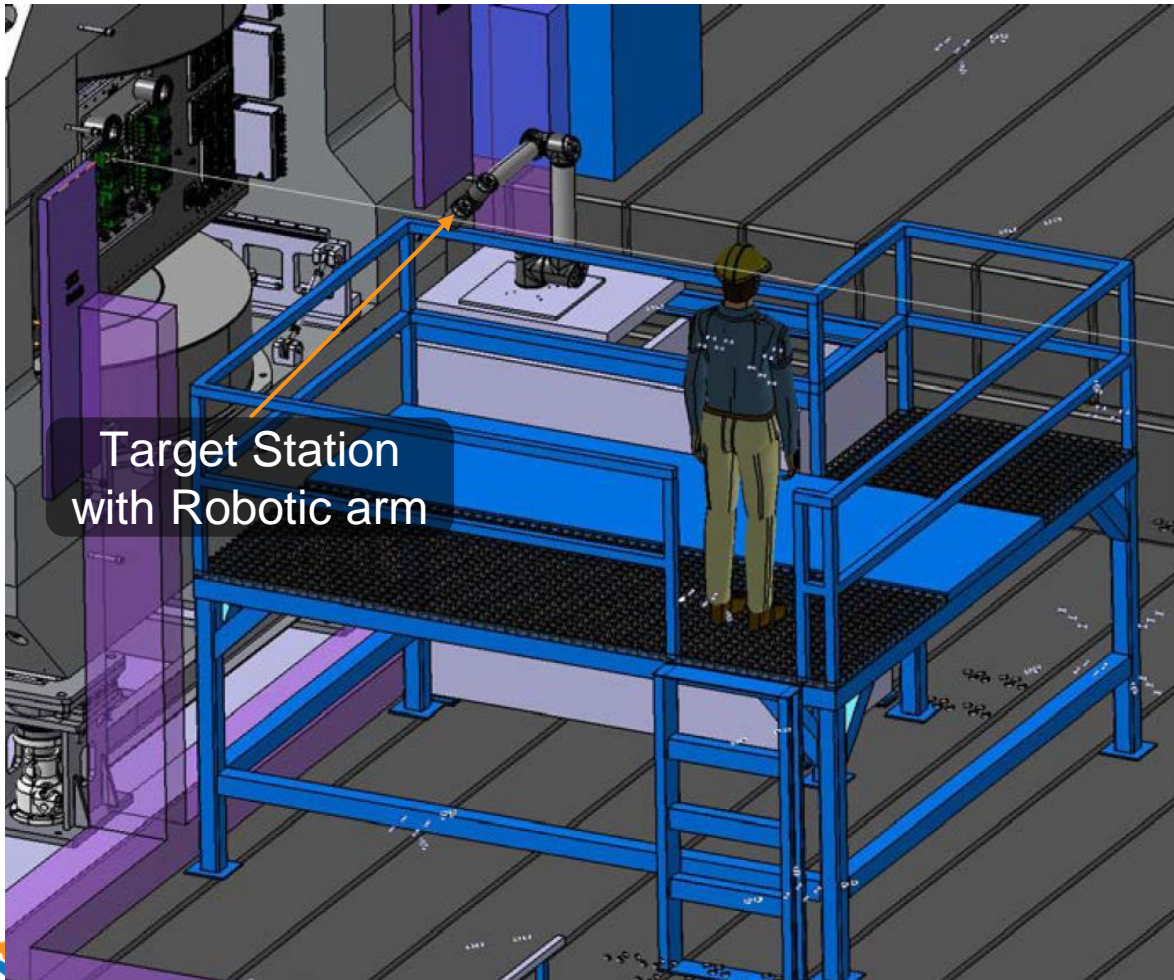
Visualization of the main differences between the GSI Cave A
and future FAIR GCR simulator concept.

CBM vault

Target Station

GCR Simulator

~10m

Reference: One Person

Technical Design Report: BIOMAT in CBM

Target Station with Robotic arm

GCR Simulator

Monitor IC

Technical Design Report: BIOMAT in CBM

Status Task 8.3: Test of the GCR simulator (GSI)

- Task 8.3 is listed as M47 – M48.

- No progress yet, as FAIR is still under construction and Task 8.2 is a requirement for this Task.

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Outlook in Year 3

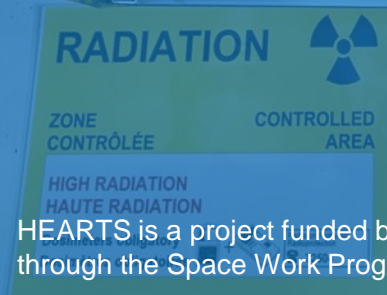- Industry test run with 2 companies will be done in early March 2025

Thank you for your attention. Questions?

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